

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method for configuring, via a computing device having a display device and an input device, a function block associated with a process plant, the function block to implement a state machine, the method comprising:
providing a first graphical user interface via the display device to configure values of at least some outputs of a plurality of outputs of the function block for each of at least some states of a plurality of states of the state machine, wherein the first graphical user interface includes a plurality of graphical elements, wherein at least some graphical elements of the plurality of the graphical elements are associated with respective pairings of ones of the at least some states with ones of the at least some outputs;
wherein the at least some outputs are to be used, at least in part, to effect one or more physical functions within the process plant;
receiving output configuration data via the graphical user interface; and
storing the output configuration data on a first computer readable medium associated with the function block.
2. (Original) A method according to claim 1, wherein the plurality of graphical elements comprises a plurality of cells, wherein the cells of the plurality of cells are associated with respective pairings of ones of the at least some states with ones of the at least some outputs; and
wherein receiving the output configuration data comprises receiving output configuration data associated with at least some of the plurality of cells via the input device, wherein the output configuration data of each cell of the at least some of the plurality of cells is indicative of a desired value of the corresponding output when the state machine is in the corresponding state.
3. (Original) A method according to claim 2, further comprising displaying on the display device indications of the output configuration data in appropriate cells of the plurality of cells.

4. (Original) A method according to claim 2, wherein displaying on the display device the plurality of cells comprises displaying on the display device a matrix comprising the plurality of cells, the matrix comprising a plurality of rows of cells and a plurality of columns of cells, wherein each row of the plurality of rows is associated with a corresponding output of the at least some outputs, wherein each column of the plurality of columns is associated with a corresponding state of the at least some states.

5. (Original) A method according to claim 2, wherein displaying on the display device the plurality of cells comprises displaying on the display device a matrix comprising the plurality of cells, the matrix comprising a plurality of rows of cells and a plurality of columns of cells, wherein each row of the plurality of rows is associated with a corresponding state of the at least some states, wherein each column of the plurality of columns is associated with a corresponding output of the at least some outputs.

6. (Original) A method according to claim 2, further comprising:
receiving data, via the input device, indicative of a number of outputs in the plurality of outputs; and
determining a number of cells in the plurality of cells based on the number of outputs.

7. (Original) A method according to claim 6, further comprising:
receiving data, via the input device, indicative of a number of states in the plurality of states;
wherein determining the number of cells in the plurality of cells comprises determining the number of cells based on the number of outputs and the number of states.

8. (Original) A method according to claim 2, further comprising:
receiving data, via the input device, indicative of a number of states in the plurality of states; and
determining a number of cells in the plurality of cells based on the number of states.

9. (Original) A method according to claim 1, further comprising receiving data, via the graphical user interface, indicative of whether one or more, if any, of the at least some outputs should be forced to a particular value irrespective of a current state of the state machine.

10. (Original) A method according to claim 1, further comprising providing a second graphical user interface via the display device for specifying how the state machine is to transition among states of the plurality of states, wherein the graphical user interface includes a plurality of graphical elements, wherein at least some of the graphical elements can be used to specify that the state machine should transition between states based on at least one input to the function block;

wherein the at least one input is to be associated with the process plant;
receiving state transition data via the second graphical user interface; and
storing the state transition data on a second computer readable medium associated with the function block.

11. (Original) A method according to claim 10, wherein the at least one input is to be received from at least one other function block associated with the process plant.

12. (Original) A method according to claim 10, wherein the at least one input is to be received from an operator interface.

13. (Original) A method according to claim 10, wherein the first computer readable medium comprises the second computer readable medium.

14. (Original) A method according to claim 10, further comprising receiving data, via the graphical user interface, indicative of how the state machine is to transition among the states of the plurality of states if one or more of the at least one input has a BAD status.

15. (Original) A method according to claim 10, wherein the plurality of outputs of the function block are to be provided to a process control system associated with the process plant.

16. (Original) A method according to claim 10, wherein the plurality of outputs of the function block are to be provided to a safety system associated with the process plant.

17. (Original) A tangible medium storing machine readable instructions comprising:

first code to provide a first graphical user interface via a display device of a computing device to configure values of at least some outputs of a plurality of outputs of a function block associated with a process plant for each of at least some states of a plurality of states of a state machine to be implemented by the function block;

wherein the at least some outputs are to be used, at least in part, to effect one or more physical functions within the process plant;

second code to receive output configuration data via the graphical user interface; and

third code to store the output configuration data on a first computer readable medium associated with the function block.

18. (Original) A tangible medium according to claim 17, wherein the first code comprises fourth code to display on the display device a plurality of cells associated with the function block, wherein each cell of the plurality of cells corresponds to a respective one of the at least some outputs and a respective one of the at least some states of the plurality of states of the state machine; and

wherein the second code comprises fifth code to receive output configuration data associated with at least some of the plurality of cells via an input device of the computing device, wherein the output configuration data of each cell of the at least some of the plurality of cells is indicative of a desired value of the corresponding output when the state machine is in the corresponding state.

19. (Original) A tangible medium according to claim 18, further comprising sixth code to display on the display device indications of the output configuration data in appropriate cells of the plurality of cells.

20. (Original) A tangible medium according to claim 18, wherein the fourth code comprises sixth code to display on the display device a matrix comprising the plurality of cells, the matrix comprising a plurality of rows of cells and a plurality of columns of cells, wherein each row of the plurality of rows is associated with a corresponding output of the at least some outputs, wherein each column of the plurality of columns is associated with a corresponding state of the at least some states.

21. (Original) A tangible medium according to claim 18, wherein the fourth code comprises sixth code to display on the display device a matrix comprising the plurality of cells, the matrix comprising a plurality of rows of cells and a plurality of columns of cells, wherein each row of the plurality of rows is associated with a corresponding state of the at least some states, wherein each column of the plurality of columns is associated with a corresponding output of the at least some outputs.

22. (Original) A tangible medium according to claim 18, further comprising:
sixth code to receive data, via the input device, indicative of a number of outputs in the plurality of outputs; and
seventh code to determine a number of cells in the plurality of cells based on the number of outputs.

23. (Original) A tangible medium according to claim 22, further comprising:
eighth code to receive data, via the input device, indicative of a number of states in the plurality of states;
wherein the seventh code comprises ninth code to determine the number of cells based on the number of outputs and the number of states.

24. (Original) A tangible medium according to claim 18, further comprising:
sixth code to receive data, via the input device, indicative of a number of states in the plurality of states; and
sixth code to determine a number of cells in the plurality of cells based on the number of states.

25. (Original) A tangible medium according to claim 17, further comprising fourth code to receive data, via the graphical user interface, indicative of whether one or more, if any, of the at least some outputs should be forced to a particular value irrespective of a current state of the state machine.

26. (Original) A tangible medium according to claim 17, further comprising fourth code to provide a second graphical user interface via the display device for specifying how the state machine is to transition among states of the plurality of states, wherein the graphical user interface includes a plurality of graphical elements, wherein at least some of the graphical elements can be used to specify that the state machine should transition between states based on at least one input to the function block;
wherein the at least one input is to be associated with the process plant;
fifth code to receive state transition data via the second graphical user interface; and
sixth code to store the state transition data on a second computer readable medium associated with the function block.

27. (Original) A tangible medium according to claim 26, wherein the at least one input is to be received from at least one other function block associated with the process plant.

28. (Original) A tangible medium according to claim 26, wherein the at least one input is to be received from an operator interface.

29. (Original) A tangible medium according to claim 26, wherein the first computer readable medium comprises the second computer readable medium.

30. (Original) A tangible medium according to claim 26, further comprising seventh code to receive data, via the graphical user interface, indicative of how the state machine is to transition among the states of the plurality of states if one or more of the at least one input has a BAD status.

31. (Original) A tangible medium according to claim 26, wherein the plurality of outputs of the function block are to be provided to a process control system associated with the process plant.

32. (Original) A tangible medium according to claim 26, wherein the plurality of outputs of the function block are to be provided to a safety system associated with the process plant.

33. (Original) A method of implementing a function block for use in controlling one or more field devices in a process plant, the method comprising:
providing a graphical user interface via a display of a computing device to configure values of at least some outputs of a plurality of outputs of the function block for each of at least some states of a plurality of states of a state machine to be implemented by the function block;
wherein the at least some outputs are to be used, at least in part, to effect one or more physical functions within the process plant;
receiving output configuration data via the graphical user interface;
storing the output configuration data on a first computer readable medium associated with the function block;
receiving at least one input associated with the process plant;
changing a current state of the state machine, if necessary, based, at least in part, on the at least one input;
retrieving, based on at least the current state, output configuration data associated with the current state from the first computer readable medium; and
setting the at least some outputs based, at least in part, on the retrieved output configuration data.

34. (Original) A method according to claim 33, wherein the at least one input is to be received from at least one other function block associated with the process plant.

35. (Original) A method according to claim 33, wherein the at least one input is to be received from an operator interface.

36. (Original) A method according to claim 33, wherein the output configuration data includes data indicative of whether one or more of the at least some outputs should be set to a particular value irrespective of the current state of the state machine;

wherein setting the at least some outputs is further based, at least in part, on the data indicative of whether the one or more of the at least some outputs should be set to the particular value.

37. (Original) A method according to claim 33, wherein the at least one input comprises an increment input and a decrement output;

wherein changing the current state of the state machine comprises incrementing the current state if the increment input indicates that the current state should be incremented; and

wherein changing the current state of the state machine further comprises decrementing the current state if the decrement input indicates that the current state should be incremented.

38. (Original) A method according to claim 37, wherein the at least one input further comprises an input indicative of whether, if the current state is a highest enabled state, incrementing the current state should comprise setting the current state to a lowest enabled state; and

wherein the at least one input further comprises an input indicative of whether, if the current state is the lowest enabled state, decrementing the current state should comprise setting the current state to the highest enabled state.

39. (Original) A method according to claim 38, wherein the input indicative of whether, if the current state is the highest enabled state, incrementing the current state should comprise setting the current state to the lowest enabled state, and the input indicative of whether, if the current state is the lowest enabled state, decrementing the current state should comprise setting the current state to the highest enabled state, comprise a single input.

40. (Original) A method according to claim 33, further comprising:
receiving an input indicative of whether the function block is to be disabled;
and

if the input indicative of whether the function block is to be disabled indicates that the function block is to be disabled, setting the current state of the state machine to a disabled state.

41. (Original) A method according to claim 40, further comprising:
receiving an input indicative of whether the state machine is to be set to an initial state; and

if the input indicative of whether the state machine is to be set to the initial state indicates that the state machine should be set to the initial state, setting the current state of the state machine to the initial state;

wherein the input indicative of whether the state machine function block is to be enabled and the input indicative of whether the state machine function block is to be set to the initial state comprise a single input.

42. (Original) A method according to claim 33, further comprising:
receiving an input indicative of whether the state machine is to be set to an initial state; and

if the input indicative of whether the state machine is to be set to the initial state indicates that the state machine should be set to the initial state, setting the current state of the state machine to the initial state.

43. (Original) A method according to claim 33, further comprising:

receiving an input indicative of whether the state machine function block is to be set to a desired state;

receiving an input indicative of the desired state; and

if the input indicative of whether the state machine function block is to be set to the desired state indicates that the state machine function block should be set to the desired state, setting the current state of the state machine to the desired state.

44. (Original) A method according to claim 33, further comprising providing at least one output of the plurality of outputs that is indicative of the current state of the state machine.

45. (Original) A method according to claim 33, wherein the plurality of outputs of the function block are to be provided to a process control system associated with the process plant.

46. (Original) A method according to claim 33, wherein the plurality of outputs of the function block are to be provided to a safety system associated with the process plant.

47. (Currently Amended) A function block entity for use in a process plant having a processor adapted to control one or more field devices, the function block entity comprising:

a user modifiable state machine configuration database including output configuration data indicative of values of at least some outputs of a plurality of outputs of the function block for each of at least some states of a plurality of states of a state machine to be implemented by the function block;

wherein the at least some outputs are to be used, at least in part, to effect one or more physical functions within the process plant;

a first computer readable medium;

first code stored on the first computer readable medium to receive at least one input associated with the process plant;

second code stored on the first computer readable medium to change a current state of the state machine, if necessary, based, at least in part, on the at least one input, wherein the second code is fixed;

third code stored on the first computer readable medium to retrieve, based on at least the current state, output configuration data associated with the current state from the configuration database, wherein the second code is fixed; and

fourth code stored on the first computer readable medium to set the at least some outputs based, at least in part, on the retrieved output configuration data.

48. (Original) A function block entity according to claim 47, wherein the at least one input is to be received from at least one other function block associated with the process plant.

49. (Original) A function block entity according to claim 47, wherein the at least one input is to be received from an operator interface.

50. (Original) A function block entity according to claim 47, wherein the state machine configuration database is stored on the first computer readable medium.

51. (Original) A function block entity according to claim 47, wherein the state machine configuration database is stored on a second computer readable medium different from the first computer readable medium.

52. (Original) A function block entity according to claim 47, wherein the configuration database includes data indicative of whether one or more of the at least some outputs should be set to a particular value irrespective of the current state of the state machine;

wherein the fourth code comprises fifth code stored on the first computer readable medium includes fifth code stored on the first computer readable medium to set the at least some of the outputs further based, at least in part, on the data indicative of whether the one or more of the at least some outputs should be set to the particular value irrespective of the current state of the state machine.

53. (Original) A function block entity according to claim 47, wherein the at least one input comprises an increment input and a decrement input;

wherein the second code comprises fifth code stored on the first computer readable medium to increment the current state if the increment input indicates that the current state of the state machine should be incremented;

wherein the second code further comprises sixth code stored on the first computer readable medium to decrement the current state if the decrement input indicates that the current state of the state machine should be decremented.

54. (Original) A function block entity according to claim 53, wherein the at least one input further comprises an input indicative of whether, if the current state is a highest enabled state, incrementing the current state should comprise setting the current state to a lowest enabled state; and

wherein the at least one input further comprises an input indicative of whether, if the current state is the lowest enabled state, decrementing the current state should comprise setting the current state to the highest enabled state.

55. (Original) A function block entity according to claim 54, wherein the input indicative of whether, if the current state is a highest enabled state, incrementing the current state should comprise setting the current state to the lowest enabled state, and the input indicative of whether, if the current state is the lowest enabled state, decrementing the current state should comprise setting the current state to the highest enabled state, comprise a single input.

56. (Original) A function block entity according to claim 47, wherein the at least one input comprises an input indicative of whether the function block is to be disabled, the function block entity further comprising:

fifth code stored on the first computer readable medium to set the current state of the state machine to a disabled state if the input indicative of whether the function block is to be disabled indicates that the function block is to be disabled.

57. (Original) A function block entity according to claim 56, wherein the at least one input comprises an input indicative of whether the state machine is to be set to an initial state, the function block entity further comprising:

sixth code stored on the first computer readable medium to set the current state of the state machine to the initial state if the input indicative of whether the state machine is to be set to the initial state indicates that the state machine is to be set to the initial state;

wherein the input indicative of whether the function block is to be disabled and the input indicative of whether the state machine is to be set to the initial state comprise a single input.

58. (Original) A function block entity according to claim 47, wherein the at least one input comprises an input indicative of whether the state machine is to be set to an initial state, the function block entity further comprising:

fifth code stored on the first computer readable medium to set the current state of the state machine to the initial state if the input indicative of whether the state machine is to be set to the initial state indicates that the state machine is to be set to the initial state.

59. (Original) A function block entity according to claim 47, wherein the at least one input comprises an input indicative of whether the state machine is to be set to a desire state, and an input indicative of the desired state, the function block entity further comprising:

fifth code stored on the first computer readable medium to set the current state of the state machine to the desired state if the input indicative of whether the state machine is to be set to the desire state indicates that the state machine is to be set to the desire state.

60. (Original) A function block entity according to claim 47, further comprising fifth code stored on the first computer readable medium to provide at least one output indicative of the current state of the state machine.

61. (Original) A function block entity according to claim 47, wherein the plurality of outputs of the function block are to be provided to a process control system associated with the process plant.

62. (Original) A function block entity according to claim 47, wherein the plurality of outputs of the function block are to be provided to a safety system associated with the process plant.

63. (Original) A method of implementing a function block for use in simulating control of one or more field devices in a process plant, the method comprising:
providing a graphical user interface via a display of a computing device to configure values of at least some outputs of a plurality of outputs of the function block for each of at least some states of a plurality of states of a state machine to be implemented by the function block;

wherein the at least some outputs are to be used, at least in part, to simulate operation of at least one of a process control system and a safety system associated with the process plant;

receiving output configuration data via the graphical user interface;

storing the output configuration data on a first computer readable medium associated with the function block;

receiving at least one input associated with the process plant;

changing a current state of the state machine, if necessary, based, at least in part, on the at least one input;

retrieving, based on at least the current state, output configuration data associated with the current state from the first computer readable medium; and

setting the at least some outputs based, at least in part, on the retrieved output configuration data.

64. (New) A method according to claim 2, wherein displaying on the display device the plurality of cells comprises displaying on the display device a matrix comprising the plurality of cells, the matrix comprising a plurality of rows of cells and a plurality of columns of cells, wherein one of each row of the plurality of rows or each column of the plurality of columns is associated with a corresponding output of the at least some outputs, wherein the other one of each row of the plurality of rows or each column of the plurality of columns is associated with a corresponding state of the at least some states.

65. (Original) A tangible medium according to claim 18, wherein the fourth code comprises sixth code to display on the display device a matrix comprising the plurality of cells, the matrix comprising a plurality of rows of cells and a plurality of columns of cells, wherein one of each row of the plurality of rows or each column of the plurality of columns is associated with a corresponding output of the at least some outputs, wherein the other one of each row of the plurality of rows or each column of the plurality of columns is associated with a corresponding state of the at least some states.